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Cementing of Geothermal Wells

*3/7/03 M. Sakitt (OS)  
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Progress Report No. 1  
April-June 1976

Process Technology Division

BROOKHAVEN NATIONAL LABORATORY  
UPTON, NEW YORK 11973

INFORMAL REPORT



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BROOKHAVEN NATIONAL LABORATORY  
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### Abstract

A coordinated program for the development of improved cements specifically designed for geothermal well applications was initiated in April 1976. A successful program will lead to a major advance in the technology required to economically utilize geothermal energy.

The goals for the overall program are as follows:

1. Preparation of an integrated research and development plan for the investigation of new well-cementing materials specifically designed for geothermal well applications.
2. To provide the technical basis for the development, testing, and practical demonstration of high-temperature cementing materials for geothermal wells.
3. Rapid transfer and implementation of the technology in the private sector.

To date, a preliminary management plan has been prepared and the state of the art of well cementing is being determined by a series of meetings with companies that develop and utilize the technology.

### Summary

Technical discussions to determine the state of the art and the potential for new geothermal well cementing materials are being held with well owners, cementing service companies, and governmental and private laboratories. The consensus has been that well cementing problems do exist and that improved materials are needed. At present, the small scale of geothermal exploration makes it impractical for the private sector to develop the materials without ERDA assistance. An ERDA-sponsored facility for down-hole testing of cements is recommended.

# Cementing of Geothermal Wells

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## Introduction

The cementing of a well is considered to be the most critical single aspect in the development of a geothermal energy source. The production life of a well, which can be 30 to 50 years, may depend entirely on the quality of the cementing operation.

Portland or other forms of hydrated cement which are most widely used today do not exhibit adequate durability and strength properties in geothermal environments. Also, large variations in the cure time occur between batches of cement. Premature setting of the cement is not uncommon and results in plugging of the well, necessitating costly redrilling.

The Process Technology Division of the Department of Applied Science at BNL is assisting the Division of Geothermal Energy of ERDA in developing and managing a program on well cementing materials. The program plan will represent an integrated approach to the definition, development, and implementation of the work. A successful development of improved materials will lead to a major advance in the technology required to economically utilize geothermal energy.

The goals for the overall program are as follows:

1. Preparation of an integrated research and development plan for the investigation of new well-cementing materials specifically designed for geothermal-well applications.

2. To provide the technical basis for the development, testing, and practical demonstration of high-temperature cementing materials for geothermal wells.

3. Rapid transfer and implementation of the technology in the private sector.

The program goals will be achieved by performing the following tasks:

1. Develop well-cementing materials capable of withstanding the environmental conditions in geothermal wells.

2. Perform pilot-scale testing and analysis of the cementing materials at down-hole well conditions.

3. Develop the technology required to mix, pump, and place the cementing material.

4. Demonstrate the process by the cementing of a prototype well.

5. Perform cost analyses to determine the economic viability of the cementing systems under investigation.

6. Involve the well-cementing service industry and well owners in all phases of the program in order to provide a technical basis for the rapid implementation of the technology.

7. Prepare a comprehensive, high-temperature geothermal well-cementing manual which will include details of downhole equipment, pumps, cement properties, and field examples.

Planning work to organize and develop a management plan designed to meet the above objectives was started in April 1976. Starting in FY 1977, experimental and developmental work will commence through subcontracting and in-house efforts. The work at BNL will involve in-house research on polymer-concrete cementing materials as well as full management of an integrated program involving substantial subcontract efforts and industrial participation.

This report constitutes the first in a series of quarterly reports describing work performed at BNL on the program. Accomplishments during the period April-June 1976 are summarized below. All of the work has been performed in Task 1 of the program. Work in other tasks will commence during the transition quarter and FY 1977 as the management plan is developed.

Task 1. Program Management Plan

The need for the Division of Geothermal Energy of ERDA to sponsor a program to develop improved cementing materials for use in geothermal wells is being determined. As part of the evaluation process, technical discussions to determine the state of the art and the potential for new materials are being held with geothermal well owners, well cementing service



companies, and governmental and private laboratories.

During the current report period discussions were held with the groups listed below.

Laboratories

Location

Bartlesville Energy Research Center  
U.S. Army Waterways Experiment Station

Bartlesville, Oklahoma  
Vicksburg, Mississippi

Well Cementing Service Companies

Halliburton Services  
Dowell Division of Dow Chemical Company

Duncan, Oklahoma  
Tulsa, Oklahoma

Well Owners

Sun Oil Company  
Exxon Company, USA  
Gulf Research and Development  
Amoco Production Company  
Phillips Petroleum Company

Richardson, Texas  
Houston, Texas  
Houston, Texas  
Tulsa, Oklahoma  
Bartlesville, Oklahoma

Trip reports on individual meetings have been submitted to the ERDA, Division of Geothermal Energy.

Permission to visit the Union Oil Research Center at Brea, California was requested, but to date a reply has not been received.

The consensus of those contacted was that the current state of well completion knowledge does not cover conditions which are known to exist in many geothermal areas and that improved cementing materials are needed. It was also stated that the relatively small scale of geothermal exploration makes it impractical for the private sector to extend oil-well completion knowledge to geothermal wells without ERDA assistance.

Down-hole testing of new materials was believed to be a more meaningful and economical way of testing new materials. An ERDA-sponsored test facility would be a major contribution to the development of cementing materials.

All of the companies contacted that are working in geothermal energy expressed a desire to cooperate with ERDA. The type and extent of the cooperation will depend upon priorities and the ERDA patent policy. To date, one company has submitted a preliminary copy of a research plan to develop new cements.

During the next report period, technical discussions will be continued with companies active in geothermal energy development programs and with government and private laboratories. Based upon these discussions, a program plan will be prepared and submitted to ERDA for review and approval. It is anticipated that experimental work for the selection of new cementing materials will be initiated.

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